POTENTIAL HIGHLANDS LANDING SITES FOR MARS SURVEYOR 2001. Nadine G. Barlow, Department of Physics, University of Central Florida, Orlando, FL 32816. ngb@physics.ucf.edu.

The original plan for the Mars Surveyor 2001 lander was to land in a location which may have been conducive to ancient martian life and use the sampling capabilities of the rover to collect materials which could contain biogenic evidence. However, the recent revisions to the mission architecture removes the sampling capabilities and thus changes the goal of this mission to exploring the landing location with a rover similar in design to Sojourner but carrying the more detailed Athena rover science instrumentation. Although identifying locations which may have been conducive to the existence of martian life is still a major emphasis of this mission, the lack of sampling capability means that this mission will be more focused on providing in-depth information about the landing area. The heavily cratered southern highlands will be a prime location for the Mars Surveyor 2001 lander for the following reasons: (1) the ancient age of this region provides the opportunity to investigate soil and rocks formed early in martian history, and (2) most models of Mars' geologic history indicate that conditions conducive to the existence of martian lifeforms were present only during the period when the highlands existed. Thus, a highlands landing site would provide a new perspective of martian geologic history, including information about sites which may have been able to support ancient life. This is a perspective lacking from current surface lander investigations due to their location on the younger northern plains.

The engineering constraints combined with the limited high-resolution Viking coverage have severely restricted the possible range of landing sites. Using the maps located on the MS01 Landing Site web page for elevation, rock abundance, thermal inertia, and Viking coverage, I have identified four highlands sites which could provide interesting environments for the study of ancient martian materials. These sites, in order of possible interest, are as follows: (1) Sinus Sabaeus (9.12°S 347.81°W): (2) Ravi Vallis region (2.8°S 40.8°W); (3) Amenthes Boundary area (2.5°N 241.5°W); and (4) Iani Chaos region (5°S 21°W). Table 1 provides information on the regions surrounding each of the proposed landing sites (55-km diameter circles centered on the proposed landing site).

Site 1: Sinus Sabaeus (9.12°S 347.81°W). This proposed landing site is located in the Terra Sabaea region south of the Schiaparelli impact basin (Figure 1). The region is mapped as Noachian aged dissected plains (Npld) [1] and contains numerous small valley network channels. The proposed landing site is in a smooth region near the confluence of many of these channels and may represent channel depositional material. Thus this site provides the opportunity to analyze possible fluvial deposits originating from the surrounding Noachian-aged terrain. A few small craters (<5-km diameter) are found in the landing site region but ejecta deposits are probably rare since few large fresh craters which could provide such ejecta are seen in the immediate area. Based on information from the web site maps, this region has an elevation of <1.5 km, a fine component thermal inertia value between 4 and 5, and approximately 5% rock abundance. Viking Orbiter imagery of this region includes resolutions between 32 and 42 m/px. The disadvantage to this site is its possible roughness. The high-resolution Viking imagery indicates that the landing site region (see Table 1 for boundaries) is dissected by a number of ridges and gullies, likely produced by the valley network channeling or other fluvial activity. In particular, the regions directly east and west of the proposed landing site (but within the landing ellipse) appear quite rough. A few small craters (<3-km-diameter) are found within the landing site region and the northeast boundary of the 55-km-diameter circle centered on the landing site crossed the fluidized ejecta blanket of an 8.3-km-diameter crater . Nevertheless, this site provides a good opportunity to study material emplaced by ancient fluvial activity and perhaps an area where water ponded for some period of time.

Site 2: Ravi Vallis region (2.8°S 40.8°W). Ravi Vallis is an outflow channel located west of Hydraotes Chaos. It is located on Noachian-aged subdued cratered unit (Npl2) [2] which are interpreted to be thin lava flows. A smaller structurally controlled channel is found south of Ravi Vallis. To the southeast of these channels is a smooth region. The proposed landing site is on this smooth region (Figure 2). This site would allow examination of possible ancient volcanic lava flows and possibly some fluvial deposits from the channels to the north, although this possibility seems small considering the direction of water flow. There are several small craters in the landing site region, many of which are elongated and oriented in a northwest-southeast direction. These are interpreted as secondary craters. The source of these secondaries is not clear from imagery of the area, but one possibility is the 113-km-diameter crater from which Shalbatana Vallis emanates. The evidence of secondary craters in this region suggests that material excavated from depth by impact craters is likely to be found in this region. In addition to the secondary craters, a 20-km-diameter crater with a fluidized ejecta blanket is located to the northeast of the landing site. The northeastern boundary of the landing site region abuts this ejecta

blanket of this crater. This site has an elevation <1.5 km, has a fine component thermal inertia value between 6 and 8, and has an 8-10% rock abundance. Viking imagery with resolutions between 66 and 80 m/px have been identified for this site.

Site 3: Amenthes Boundary area (2.5°N 241.5°W). Site 3 is located in Noachian-aged dissected plains material [1] south of the highlands-plains dichotomy boundary (Figure 3). This area has numerous channels and ridges crossing it and is proposed to be ancient volcanic lava flows affected by fluvial erosion. The landing site is north of a highly eroded 64-km-diameter crater. High resolution Viking imagery suggests that some of the material near the landing site may be the old dissected ejecta blanket from this crater. A 12-km-diameter crater with a fresh fluidized ejecta blanket is located to the northeast of the proposed landing site. Thus this landing site provides the opportunity to examine possible old volcanic material as well as material excavated from depth by older and younger impact craters. The disadvantage of this site is that the dissection of the terrain and possible ejecta deposits may make this area too rough for a safe landing. This site has an elevation of about 1.5 km, a fine grained TI component of about 6, and 5-10% rock abundance. The best Viking imagery of this area has resolutions between 20 and 89m/px.

Site 4: Iani Chaos region (5°S 21°W). Site 4 is located on smooth material of the Xanthe Terra region mapped as Noachian-aged subdued crater unit (Npl2) by Scott and Tanaka [2]. The proposed landing site is located west of the Iani Chaos region (Figure 4). The area is interpreted an ancient thin volcanic lava flows. There several small (<1.5-km-diameter) impact craters within the 55-km-diameter circle centered on the landing site. Most large craters in this region are heavily eroded and any ejecta deposits emplaced by them are likely weathered beyond recognition. No obvious indication of fluvial activity is seen in this region. The primary information that could be obtained in this location would data on old volcanic lava flows and weathered volcanic material. The advantage of this site over the three previously described locations is the smoothness and low rock abundance of the landing site region. This area has an elevation of less than 1.5 km, a fine grained TI component between 6 and 8, and about a 5% rock abundance. The best Viking orbiter imagery of this area has resolutions of 32 m/px.

References: [1] Greeley R. and J. E. Guest (1987), *U.S.G.S. Mis. Invest. Series Map I-1802-B.* [2] Scott D. H. and K. L. Tanaka (1986), *U.S.G.S. Misc. Invest. Series Map I-1802-A.*

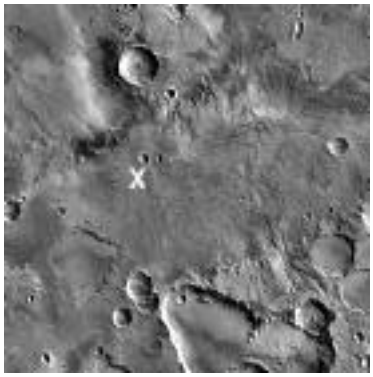

Figure 1: Proposed landing site in Sinus Sabaeus (Site 1).

Figure 2: Proposed landing site in the Ravi Vallis area (Site 2).

Figure 3: Proposed landing site in the Amenthes Boundary area (Site 3)

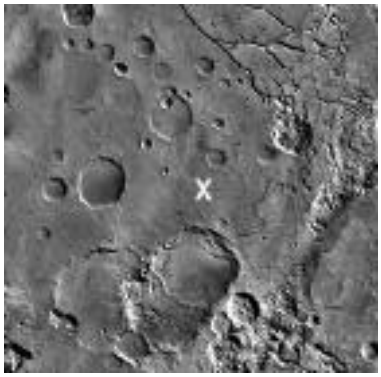

Figure 4: Proposed landing site in Iani Chaos region (Site 4).

TABLE 1: PROPOSED HIGHLANDS LANDING SITES

	Site 1 Sinus Sabaeus	Site 2 Ravi Vallis Region	Site 3 Amenthes Boundary	Site 4 Iani Chaos
Center Latitude, Longitude	9.12S, 347.81W	2.8S, 40.8W	2.5N, 241.5W	5S, 21W
Corner Latitude, Longitude				
NW Corner	8.7S, 348.3W	2.4S, 41.12W	2.85N, 241.85W	4.55S, 21.2W
NE Corner	8.7S, 347.4W	2.5S, 40.3W	2.85N, 241.15W	4.82S, 20.5W
SW Corner	9.55S, 348.3W	3.1S, 41.2W	2.15N, 241.85W	5.2S, 21.45W
SE Corner	9.55S, 347.4W	3.2S, 40.5W	2.15N, 241.15W	5.5S, 20.75W
Elevation	1-2 km	1-2 km	1-2 km	1-2 km
Rock Abundance (%)	5%	8-10%	5-10%	5%
TI (fine grain component)	4-5	6-8	6	6-8
Type of Site	Highlands	Highlands	Highlands	Highlands
Stratigraphic Unit	Npld	Npl2	Npld	Npl2
Fluvial Activity	VN site/paleolake?	Outflow channel to N	Sheet floods?	None
Excavation?	Nearby craters	Secondary craters	On possible ejecta	Nearby craters
Image numbers/Resolution	436A58 32m/px	911A07 66m/px	721A16 20m/px	378B18 32m/px
	436A82 42m/px	014A13 69m/px	099A45 79m/px	
	436A84 42m/px	014A15 69m/px	099A25 84m/px	
		012A65 70m/px	099A05 89m/px	
		012A84 80m/px		
		012A86 80m/px		